

precede an increase in admissions from the waiting list. Another possible contributing factor is that most hospitals in the Oxford region have high figures for bed occupancy, high throughput figures, and short durations of stay. In these circumstances there is little spare capacity to accommodate the effects of even fairly minor, short term declines in admissions. Thus though workload may sharply decline below the typical monthly figures, it may not be possible for it to rise commensurately above it as simple compensation.

A final possibility is that the same factors that influence the numbers of inpatients treated may also influence the capacity to see outpatients awaiting surgery and therefore to enter them on to inpatient waiting lists. Thus with regard to short term fluctuations, as work declines in admitting patients from the waiting list so it may also decline in admitting new patients to the waiting list. Conversely, as the amount of inpatient activity increases so too may the amount of outpatient activity increase as the "gateway" to the

waiting list. On a longer term basis it is also possible that the ability to meet demand acts as a positive influence for patients and their doctors to translate previously unmet needs into demand.

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# Logic in Medicine

## Doctors and witchdoctors: Which doctors are which?—II

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At the end of last week's discussion of inductivism and its criticism by Hume we found ourselves on the horns of a trilemma. Either we continue to insist that what characterises empirical science is its use of the inductive method, in which case we must find some way round Hume's argument (and other difficulties); or we must conclude that empirical science is indeed just a pseudo-empirical superstition; or we must find an alternative solution to the problem of demarcation.

Most contemporary philosophers of science refuse to countenance the possibility that the theories of empirical science are simply pseudoempirical superstitions. In this they are, I think, quite right. For let us assume that we equate empirical science with pseudo-empirical superstition. We shall then have to conclude that the attempt to bring the benefits of Western medicine to other parts of the world is simply a matter of cultural imperialism as Western medical science is really no better than are the various traditional, usually superstitious, medical practices of others. Yet no one takes such a possibility seriously for a moment—least of all the inhabitants of the so called "underdeveloped world," who are, in the main, crying out for these benefits. Thus the idea, which might be taken to follow from Hume's result, that the theories of empirical science are simply pseudoempirical superstitions, on a par with primitive myths, witchcraft, or magic, is hardly acceptable to anyone.

Rejecting this horn of the trilemma thus leaves us with only two options: either we find some way round Hume's argument (and the

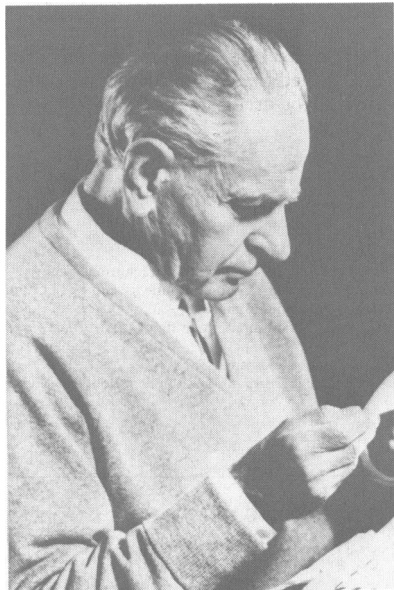
other problems facing traditional inductivism) or else we find some alternative, non-inductivist, solution to the problem of demarcation. The overwhelming majority of contemporary philosophers of science adopt the first tack. This is not to say that they still harbour the hope that Bacon's theory of induction can be made to work. Quite the contrary: most acknowledge the impossibility of a Baconian inductive method by which a theoretical understanding and explanation of phenomena may be obtained directly from these phenomena by a process of inference. Nevertheless, they continue to hold that empirical science is, when compared with myths, superstitions, and so on, a particularly secure and reliable body of knowledge as it is somehow well supported by empirical evidence. They hope either that an inductive "logic of confirmation" can be made to work without resorting to any pseudoempirical assumption or principle (perhaps because it requires no more than the logical or mathematical assumptions of the calculus of probability—for example, Bayes's theorem) or that they can justify the use of induction pragmatically (as offering the best hope of achieving the aims of science).

## Popper's non-inductivist solution

In opposition to all such attempts to salvage inductivism from the ravages of Hume's critique Sir Karl Popper<sup>1,5</sup> has suggested an elegant non-inductive solution to the problem of demarcation—one that enables us to explain, despite Hume's arguments, why the theories of empirical science are to be preferred, from the point of view of truth, to those of witchcraft, scientology, and other pseudoempirical superstitions. According to Popper, what demarcates the theories of empirical science is not that they have been reached from observation by some special method of inference, or even that they are especially well supported by observation, but rather that they are open to observational and empirical criticism

and refutation and that severe attempts have been made to discover their falsity by such means. Thus for Popper the distinguishing mark of empirical science is its insistence that only theories that are falsifiable—and hence testable—by empirical evidence be admitted; those that are admitted should then be subjected to the most severe and rigorous attempts at empirical elimination that we can devise.

Unlike traditional inductivism, Popper's solution to the problem of demarcation does not fall foul of Hume's criticism of inductive inference, for according to Popper empirical science has no need of inductive inference and so is not threatened by Hume's criticism of it.



Karl Popper.

To see this it is crucial to understand the very different role that empirical inquiry takes in Popper's view from that in the inductivist view. In traditional Baconian inductivism empirical inquiry is supposed to furnish us with the basis from which, by a process of inductive inference, the theories of empirical science are *reached*, while in contemporary inductivism empirical inquiry is supposed to furnish us with the basis on which the theories of empirical science are *supported*. In opposition to these views, Popper sees empirical inquiry as providing only the means by which the theories of empirical science are *tested*—where the aim of any test is to try to discover the falsity of our theories, not to support their claim to truth. As a theory cannot be tested unless it is already formulated there is no question here of trying to reach or infer theories from empirical evidence (for Popper our theories are our creations, our guesses, not the products of inference).

On the other hand, as the aim of any test is simply to discover whether our theories are false, and as every inference from the falsity of an empirical consequence of a theory to the falsity of the theory itself is a perfectly straightforward *deductive* inference, there is equally here no need for any inductive logic of confirmation or support. To put all this slightly differently, for Popper what present science tells us about the world has not been learnt from observation and experiment; rather, what we have learnt from observation and experiment is that much of what previous science tells us about the world is false. Thus we undoubtedly learn from our empirical inquiries, but what we have learnt is not what we know.

Now, recall that one way of formulating the problem of demarcation is as the question "How can we distinguish between genuine empirical support (or a genuine empirical method) and spurious, or pseudoempirical, support (or a pseudoempirical method)?" How does Popper's proposed solution help us with regard to this question? The answer is that it counsels us to stop looking for

empirical support altogether and to direct our attention instead towards finding observable facts that may refute our theories. As we saw before, most superstitions—like the theories of witchcraft—can seem to be supported or confirmed by empirical or observational evidence. But the same can be said of false scientific theories, such as the phlogiston theory of combustion or the Ptolemaic theory of the heavens. The simple truth is that empirical support can be found for any theory, as long as we look for it. Thus the fact that a theory may agree with many observed facts should not be taken to indicate any virtue in the theory unless the facts have been obtained as a result of our attempts to refute the theory—that is, to show by empirical means that it is false.

In other words, spurious or pseudoempirical support results from the very desire to find empirical support; a genuine empirical method results only if we relinquish this desire and instead look for empirical refutations. Thus the fact that a theory that is open to refutation by empirical testing has survived our best efforts to discover its falsity allows us, quite rationally, to uphold its claim to truth (or at least its claim to being an approximation to truth); but the mere fact that a theory can be shown to agree with many observed facts says nothing whatsoever for its truth.

This point may become clearer if we consider a theory that is not open to empirical refutation at all—and which is thus, given Popper's proposed solution to the problem of demarcation, to be excluded from the realm of empirical science. Take, for example, the hypothesis that a certain house is haunted. This may be said to agree with many observed facts—for example, creaking doors, flickering lights, mysterious disappearances of food, intermittent interference on the telephone, and so on. If we uphold the view that a theory is worthy of serious consideration from the point of view of truth simply because it can be shown to agree with many observed facts then we shall have to conclude that this hypothesis is worthy of such consideration. Yet the contrary (and, I might add, equally untestable) hypothesis that the house is not haunted can also be shown to agree with many observed facts. But both cannot be true. In the absence of any empirical means of eliminating either of them as false the fact that both can be shown to agree with many observed facts says not a jot for the truth of either.

It is, I hope, clear from all this that Popper in fact agrees with Bacon that if we start from ideas (or hypotheses) there is a great danger that we will, like the witchdoctor, interpret evidence as confirmation of our ideas. But whereas Bacon taught that the solution to this problem lay in starting with observation and avoiding hypotheses Popper holds (in effect, following Hume) that we cannot avoid hypotheses if we hope to learn from observation. Thus the only way to avoid the danger is to stop valuing, and hence looking for, confirmation altogether and to insist instead on searching for empirical refutation. But once we insist on this search we will, quite naturally, want to focus our attention on those hypotheses that are open to such refutation and to exclude from empirical science those that are not.

From Popper's point of view, then, what renders the theories of empirical science worthy of serious consideration from the point of view of truth is not that we have good empirical grounds for believing their truth but rather that they are sensitive to eliminative empirical testing, that we have marshalled our best efforts in the attempt to show that they are not true, and that we have failed in this attempt. On the other hand, what renders the theories of witchcraft, Scientology, and so on unworthy of serious consideration from the point of view of truth is not that there do not exist "good empirical grounds" for believing their truth (such "grounds" exist for every theory) but rather that they are immune to any attempt to refute them empirically or, if they are not so immune, are easily refuted as soon as the attempt is made.

## Conclusion

Popper's solution to the problem of demarcation can, I suggest, explain the rationality of our preference for Western medicine over the superstitious medical practices of, for example, the witchdoctor. In so far as Western medical practice exploits scientific theories that,

unlike the theories of witchcraft, are susceptible to empirical testing, have been severely tested, and have survived, and in so far as medicine has subjected its own independent techniques to severe empirical criticism (for example, in clinical trials) instead of merely looking for "positive instances," we have done everything that can be done to eliminate false theories and ineffective, or even harmful, techniques. This does not mean, of course, that we will thereby always get things right. Quite the contrary: the possibility of our making great new medical discoveries—and thus maintaining the superior intellectual status of medical science—will remain intact only as long as we are on the lookout for its shortcomings and are willing to modify and improve it in the light of consciously sought after failings. As Popper has aptly put it: "In politics and in medicine, he who promises too much is likely to be a quack."<sup>6</sup>

It is in this light that the recent report of the BMA on alternative medicine should be viewed. What is wrong with, say, faith healing is not that it does not have a "scientific basis" if this means that we cannot at present give any scientific explanation of its effectiveness. After all, it is perfectly possible that such practices are regularly effective in, say, curing cancer (just as the old wives' tale that milkmaids did not get smallpox turned out to be true). If this were the case then the fact that we cannot explain it within present medical science would not mean that faith healing is ineffective but rather that our present scientific knowledge is defective. But if the assertion that faith healing does not have any scientific basis means that the claims made on its behalf are incapable of being tested empirically, or have been subjected to such tests and have failed, this is quite a different matter. Of course, the defenders of faith

healing may respond to any such negative findings by rejecting altogether the appropriateness of empirical tests for evaluating their claims; but in that case they are asking the rest of us to treat them as oracles, with an unimpeachable hotline to the truth.

If the history of medicine, and indeed of all science, teaches us anything it teaches us that there are no oracles. The history of our knowledge is replete with discarded and long forgotten theories. It follows that present medical science, however testable and well tested it is, is no oracle either. Popper's solution to the problem of demarcation can help us to understand why, despite this fact, we are right to accord greater intellectual status to the theories and practices of modern medical science than we do to those of witchcraft and the witchdoctor.

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# How To Do It

## Run a clinical budget

K A M GRANT

One of the major changes that will take place over the next 10 years or so in the National Health Service concerns the ability to apportion costs directly to clinical work. At present the money available to district health authorities is split up into budgets which fund groups of staff such as doctors, nurses, or porters or which fund purchases of specific items such as medical and surgical supplies, drugs, or heating oil. These budgets are called functional budgets.

With the introduction of new computerised information systems it will soon be possible to relate the various items of patient care, such as laboratory tests and drugs, directly to a patient and also, albeit less accurately, to apportion what amount of time is spent by particular staff groups on the care of that patient. This will allow budgets to be apportioned to clinical activity. These budgets will be called clinical budgets.

**From *How To Do It: 2*, a new collection of useful advice on topics that doctors need to know about but won't find in the medical textbooks. To be published in October 1987, this is a companion volume to the popular *How To Do It: 1*, also published by the *BMJ*.**

## What difference will it make?

The benefits of this are twofold. First, health authority members and staff will be able to see much more clearly how the resources of the health authority are being spent. With the present functional budgeting system it is possible to know what proportion of a hospital's budget goes on a specific purpose—such as providing nursing care, or buying drugs—and also to work out the average cost per hospital day and the average cost of treating a patient in that hospital.

Clinical budgets will show how much is spent on particular types of care, for instance, general surgery or psychiatry. The process will allow health authority members to see whether or not this matches their priorities. It will make the whole process of resource allocation much more open, and also enable financial information to be linked